

Composite pane with a film laminate

5 The invention relates to a composite pane having a film laminate with the features of the precharacterizing clause of Patent Claim 1.

10 Composite panes which are intended for installation in vehicle sliding and lifting roofs or else as rear side windows and windscreens for vehicles are known, which are composed essentially of two rigid panes of glass or plastic, and of adhesive films which adhesively connect these two rigid panes to one another. An adhesive film whose bulk is coloured is often used in order to absorb  
15 a portion of the light which passes through the composite pane when in the installed state. The acoustic behaviour (silencing) as well as the UV resistance of the final assembly are improved by combination with an uncoloured adhesive film which is  
20 clearly transparent in its own right in the final stages. For the latter purpose, the untuned adhesive film faces the incident light or solar radiation (located on the outside) when the composite pane is in the installed state. It absorbs the majority of the  
25 incident UV radiation, which could change the colour of the coloured adhesive film in the long term.

The two adhesive films are fused on virtually completely during the final connection of the layers  
30 for this composite pane in an autoclave process at about 130 to 150°C. The finished composite pane exhibits a clearly perceptible inhomogeneous cloudy colouring when it is looked through, however, so-called "orange skin". It has been found that the rough and  
35 wavy surfaces of the films on the boundary surface between the clear and the coloured adhesive film leads to non-uniform flow phenomena in the autoclave, and to thickness fluctuations, resulting from this, in the films, whose thickness was approximately uniform before

being fused, to be precise, irrespective of whether the two films which had been laminated on to one another were originally of the same thickness, or of different thicknesses.

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The roughness and corrugation of the film surfaces are on the one hand unavoidable during production, but on the other hand, they contribute to reliable venting of the initial assembly when a reduced pressure is applied. Air which is enclosed between the layers has to be removed, as is known, and in the process flows away through the channels formed by the surface structures.

15 Composite panes are also known in which a further thermoplastic film, generally composed of PET (polyethyleneteraphthalate) is laminated in between two adhesive films in order to increase the thermal insulation, and is itself provided with a coating  
20 (which contains metal) which reflects infrared waves. A film composed of a PET-PMMA co-extrudate or co-laminate can also be used without any metal components for the same function (known by the product name 3M<sup>®</sup> SRF "solar reflecting film").

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The problem of different colouring and mixing of the adhesive films does not, of course, occur with these film laminates - with adhesive films of the same colour.

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The invention is based on the object of improving a composite pane of this generic type with a film laminate composed of differently coloured adhesive films such that optical disturbances caused by  
35 thickness fluctuations during the fusion process are avoided.

According to the invention, this object is achieved by the features of Patent Claim 1. The features of the

dependent claims indicate advantageous developments of this subject matter.

5 The undesirable optical effect can be reliably avoided by inserting at least one further intermediate layer between the coloured adhesive film and the clear adhesive film, which further intermediate layer does not change its surface in the autoclave process, and which essentially retains its physical shape, which is  
10 produced at the latest after the composite layers have been placed together. The surfaces of the adjacent adhesive films are thus uniformly flattened during the fusion process, and cannot form optically perceptible ripples.

15 By way of example, the intermediate layer may be a clear PET film, a coated PET film, for example of the Southwall XIR type, a PET-PMMA co-extrudate, for example of the 3M<sup>®</sup> SRF type, or else numerous other  
20 films (for example, composed of PC, PE, PEN, PMMA, PVC), which are optically as highly transparent as possible and whose surface and consistency do not change in the autoclave.

25 A further major requirement is, of course, that the films which are used as the intermediate layer are compatible with the adjacent adhesive films. In particular, there must be good adhesion between the adhesive films and the intermediate layer in order to  
30 avoid any risk of de-lamination. Furthermore, there must be no chemical or physical interactions which could lead to optical or mechanical disturbances during the life of the composite pane.

35 A further rigid pane could also be inserted as the intermediate layer, preferably but not exclusively an extremely thin glass or plastic pane (for example composed of polycarbonate) which, if required, can even be matched to a slight bending of the two rigid panes

of the composite pane without preforming. If the composite pane is flat and/or its total thickness and its weight are less important, then the intermediate layer may also be formed by a rigid glass or plastic pane of normal thickness (a few millimetres).

This intermediate layer embedded in the film laminate in any case results in a defined separating layer or wall, which prevents any undesirable non-uniform flowing process between the two different adhesive films even when these are fused on completely. The composite panes produced in this way are optically very homogeneously coloured when looked through.

In a further variant of the invention, additional toning of the finished product when looked through can also be achieved by suitable colouring of the intermediate layer itself. A coloured intermediate layer in addition to the tone of one adhesive film can result in different colour tones, for example, for complementary matching to surrounding colours (bodywork paint, internal equipment in the vehicle) with high flexibility and reproducibility, even in large-scale production, for composite panes intrinsically with the same configuration, in which case, of course, the basic toning of the coloured adhesive film and the additive toning of the intermediate layer must be carefully matched to one another.

Exemplary embodiment:

In order to implement the invention, two rigid panes are changed to the desired form in the normal manner (outline and possibly bending contour). The coloured adhesive film and the uncoloured adhesive film are pre-cut appropriately and a thin PET film is inserted between them. The film stack is now placed on one of the rigid panes, and is covered by the second rigid pane. The surfaces of the films are generally cut to be

somewhat smaller than the surfaces of the rigid panes. The latter may both be composed of plastic or glass, or a glass pane and a plastic pane may be used.

5 Once the pane and film stack has been vented with the aid of suitable apparatuses, the initial assembly is subjected to heat and pressure treatment in an autoclave process. During this process, the adhesive films are fused on completely and are closely and  
10 adhesively connected to the respective adjacent surfaces of the rigid pane and of the intermediate layer.

The circumferential edge gap between the two rigid  
15 panes in the plane of the film laminate is sealed by suitable means in a manner known per se, in order to prevent de-lamination starting from this point.

Alternately, instead of being placed together before  
20 being connected, the film laminate can also be taken from an initial production phase, after which either one of the adhesive films is pre-laminated with the intermediate layer, so that the second adhesive film just has to be placed on it, or all three film layers  
25 are brought together at this stage and just have to be cut to match the rigid panes.

Pre-laminates such as these are used in particular when the intermediate layer is in the form of a coated PET  
30 film, with the coated main surface being covered with an adhesive film shortly after the coating process, in order to prevent damage to the sensitive multiple layer or layer system.